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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/562,518	06/20/2006	Ralf Jonczyk	857_040	7947
25191	7590	09/16/2009	EXAMINER	
BURR & BROWN			MOWLA, GOLAM	
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/562,518

**Applicant(s)**

JONCZYK ET AL.

**Examiner**

GOLAM MOWLA

**Art Unit**

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 December 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SE-08)
- Paper No(s)/Mail Date 12/28/2005
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date \_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-6 are rejected under 35 U.S.C. 102(e) as being anticipated by Tachikawa et al. (US 2003/0056715 A1).

Regarding claims 1-6, Tachikawa teaches a silicon semiconductor substrate having a zone of reduced interstitial oxygen concentration [O] of, for example,  $3.5 \times 10^{16}$  atoms/cm<sup>3</sup> or  $3.2 \times 10^{16}$  atoms/cm<sup>3</sup> (see table 2, col. 9), which is not greater than  $3 \times 10^{17}$  atoms/cm<sup>3</sup> as required by the instant claims, to a depth of 1 mm from a surface of the substrate (see page 5, and in particular, Table 2). Since the reduced oxygen concentration goes down to 1 mm depth from a surface of the substrate, it also goes down to 75 microns, 100 microns, 125 microns, 150 microns or 175 microns, i.e. it goes down to 1-1000 microns from the surface of the substrate. The silicon substrate can further have a nitrogen concentration in the range of  $5 \times 10^{14}$  to  $1 \times 10^{16}$  atoms/cm<sup>3</sup> (see [0030]). Tachikawa's silicon semiconductor substrate inherently has a top surface, a bottom surface opposite the top surface, and an edge region connecting the top and bottom surfaces (inherent features of a structure or any layer).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tachikawa as applied to claim 1 above.

Applicant is directed above for complete discussion of Tachikawa with respect to claim 1 above, which is incorporated herein. Tachikawa further discloses the silicon substrate can further have a nitrogen concentration in the range of  $5 \times 10^{14}$  to  $1 \times 10^{16}$  atoms/cm<sup>3</sup> (see [0030]), which overlaps with the claimed range ( $10^{15}$  or more nitrogen atoms/cm<sup>3</sup>) of nitrogen concentration. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists (MPEP § 2144.05, *In re Wertheim*).

6. Claims 1-8, 13 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gee (US 5468652) in view of Tachikawa et al (US 2003/10056715 A1).

Regarding claims 1-6, 8 and 16-18, Gee teaches a metal wrap through solar cell with holes (20) extending from the first major surface to the second major surface of silicon semiconductor substrate (24) (see col. 2, line 55 through col. 3, line 46; and Figure 1).

Gee teaches the limitations of the instant claims, the difference being that Gee does not specifically teach that its silicon semiconductor substrate (24) can have the instant zone of reduced oxygen concentration.

Tachikawa teaches a silicon semiconductor substrate having a zone of reduced interstitial oxygen concentration  $[O_i]$  of, for example,  $3.5 \times 10^{16}$  atoms/cm<sup>3</sup> or  $3.2 \times 10^{16}$  atoms/cm<sup>3</sup> (see table 2, col. 9), which is not greater than  $3 \times 10^{17}$  atoms/cm<sup>3</sup> as required by the instant claims, to a depth of 1 mm from a surface of the substrate (see page 5, and in particular, Table 2). Since the reduced oxygen concentration goes down to 1 mm depth from a surface of the substrate, it also goes down to 75 microns, 100 microns, 125 microns, 150 microns or 175 microns, i.e. it goes down to 1-1000 microns from the surface of the substrate. The silicon substrate can further have a nitrogen concentration in the range of  $5 \times 10^{14}$  to  $1 \times 10^{16}$  atoms/cm<sup>3</sup> (see [0030]). Tachikawa's silicon semiconductor substrate inherently has a top surface, a bottom surface opposite the top surface, and an edge region connecting the top and bottom surfaces (inherent

features of a structure or any layer). Tachikawa's silicon semiconductor substrate provides the advantage of an improved defect-free zone ([0001-0005]).

It would have been obvious to one of ordinary skill in the art to have used Tachikawa's silicon semiconductor substrate for the silicon semiconductor substrate in Gee's solar cell because Tachikawa's silicon semiconductor substrate provides the advantage of an improved defect-free zone.

Regarding claim 7, Tachikawa further discloses the silicon substrate can further have a nitrogen concentration in the range of  $5 \times 10^{14}$  to  $1 \times 10^{16}$  atoms/cm<sup>3</sup> (see [0030]), which overlaps with the claimed range ( $10^{15}$  or more atoms/cm<sup>3</sup>) of nitrogen concentration. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists (MPEP § 2144.05, *In re Wertheim*).

Regarding claims 13 and 16, the determination of an appropriate thickness and surface area for Gee's in view of Tachikawa et al's semiconductor substrate would have been within the skill of an artisan. In the case where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (MPEP § 2144.05 IIA, *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

7. Claims 1-7 and 9-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tange (US 6005185) in view of Tachikawa et al (US 2003/10056715 A1).

Regarding claims 1-6, 9-12, 14-15 and 17-18, Tange teaches a solar cell (10) formed from a silicon wafer having a thickness of 300 to 700  $\mu\text{m}$ , wherein the wafer

surface has ridges and valleys at reference sign (16); and has a portion near reference sign (14) at the perimeter that is thicker than the rest of the wafer (see col. 2, line 45 through col. 3, line 50; and Figure 1).

Tange teaches the limitations of the instant claims, the difference being that Tange does not specifically teach that its silicon wafer can have the instant zone of reduced oxygen concentration.

Tachikawa teaches a silicon semiconductor substrate having a zone of reduced interstitial oxygen concentration  $[O_i]$  of, for example,  $3.5 \times 10^{16}$  atoms/cm<sup>3</sup> or  $3.2 \times 10^{16}$  atoms/cm<sup>3</sup> (see table 2, col. 9), which is not greater than  $3 \times 10^{17}$  atoms/cm<sup>3</sup> as required by the instant claims, to a depth of 1 mm from a surface of the substrate (see page 5, and in particular, Table 2). Since the reduced oxygen concentration goes down to 1 mm depth from a surface of the substrate, it also goes down to 75 microns, 100 microns, 125 microns, 150 microns or 175 microns, i.e. it goes down to 1-1000 microns from the surface of the substrate. The silicon substrate can further have a nitrogen concentration in the range of  $5 \times 10^{14}$  to  $1 \times 10^{16}$  atoms/cm<sup>3</sup> (see [0030]). Tachikawa's silicon semiconductor substrate inherently has a top surface, a bottom surface opposite the top surface, and an edge region connecting the top and bottom surfaces (inherent features of a structure or any layer). Tachikawa's silicon semiconductor substrate provides the advantage of an improved defect-free zone ([0001-0005]).

It would have been obvious to one of ordinary skill in the art to have used Tachikawa's silicon semiconductor substrate for the silicon wafer in Tange's solar cell

because Tachikawa's silicon semiconductor substrate provides the advantage of an improved defect-free zone.

Regarding claim 7, Tachikawa further discloses the silicon substrate can further have a nitrogen concentration in the range of  $5 \times 10^{14}$  to  $1 \times 10^{16}$  atoms/cm<sup>3</sup> (see [0030]), which overlaps with the claimed range ( $10^{15}$  or more atoms/cm<sup>3</sup>) of nitrogen concentration. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists (MPEP § 2144.05, *In re Wertheim*).

Regarding claims 13 and 16, the determination of an appropriate thickness and surface area for Tange's in view of Tachikawa's semiconductor substrate would have been within the skill of an artisan. In the case where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (MPEP § 2144.05 IIA, *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)).

***Correspondence/Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GOLAM MOWLA whose telephone number is (571) 270-5268. The examiner can normally be reached on M-F, 0900-1700 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ALEXA NECKEL can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/G. M./  
Examiner, Art Unit 1795

/Jennifer K. Michener/  
Supervisory Patent Examiner, Art Unit 1795